Provincial Report

Mathematics 30
Grade 12 Diploma Examination

April 1984

Student Evaluation

Alberta
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PREFACE

This report presents the provincial results of the Mathematics 30 Diploma Examination administered on January 31, 1984. During this first administration, the Mathematics 30 Diploma Examination was written by 7568 students. This report is intended to provide more information about the examination development process, the examination itself, and the examination results.

ACKNOWLEDGMENTS

This first administration of the Mathematics 30 Diploma Examination was successful due to the concerted effort of all involved. Success would have been impossible without substantial contributions from many people, particularly the administrators, teachers, and students, who extended their full co-operation.

The technical expertise and advice received from the Examination Review Committee regarding design, development, and reporting have been particularly valuable in the implementation of this diploma examination. This Committee has representation from:

The Alberta Teachers' Association
The Conference of Alberta School Superintendents
The Universities Co-ordinating Council
The Public Colleges of Alberta
Alberta Education

The contribution of this group is gratefully acknowledged.

Lloyd E. Symyrozum
Director
Student Evaluation Branch

CHAPTER 1

Grade 12 Diploma Examinations Program

Introduction

All Grade 12 students in Alberta are now required to write at least ONE diploma examination to receive a high school diploma. Mature students may receive credits for a Grade 12 course by writing the appropriate diploma examination. They are not required to be registered in the course. The Grade 12 Diploma Examinations Program, which is an integral part of the high school diploma requirements, is intended to develop and maintain excellence in educational standards through certification of academic achievement.

The Diploma Examinations Program consists of course-specific examinations that are based on the prescribed *Program of Studies for Senior High Schools* for the following Grade 12 courses: English 30, English 33, Social Studies 30, Mathematics 30, Biology 30, Chemistry 30, and Physics 30.

Alberta Education issues two distinct high school diplomas: the General High School Diploma and the Advanced High School Diploma.

General High School Diploma

To earn a General High School Diploma, a student must obtain course credit in either English 30 or English 33, and obtain 100 credits distributed over courses as specified in the *Junior-Senior High School Handbook*. Some students who are working toward the general diploma may wish to obtain credits in other diploma examination courses (i.e., Social Studies 30, Mathematics 30, Biology 30, Chemistry 30, and Physics 30). To obtain credits in these courses, a student must also write the appropriate diploma examination regardless of the type of diploma he wishes to receive.

Advanced High School Diploma

The Advanced High School Diploma represents achievement in an academic program that includes language arts (English), social studies, mathematics, and science. To earn an Advanced High School Diploma, a student must satisfy the current course and credit requirements for a General High School Diploma, and obtain course credits in English 30, Social Studies 30, Mathematics 30, and ONE of Biology 30, Chemistry 30, or Physics 30.

Awarding of Course Credits

Grade 10 and Grade 11 Courses. To obtain credits in Grade 10 (10-level) and Grade 11 (20-level) courses, a student must earn a final mark of 40% or better. A student who has achieved a mark of 50% or higher in a given course is eligible to take the next or higher-rank high school course in that sequence.

Grade 12 Courses. To obtain credit in a Grade 12 (30-level) course, a student must earn a final mark of 50% or better. To obtain credit in a Grade 12 diploma examination course, a student must write the appropriate diploma examination and attain a final blended mark of 50% or better. The final blended mark is made up of 50% of the mark awarded by the school and 50% of the diploma examination mark. For example, a student taking Chemistry 30 might have a mark of 45% from his school and a mark of 57% on the diploma examination. This student would earn credits for Chemistry 30 because his final mark would be 51%, which is the average of the school and examination marks. For mature students who do not have a school mark or who have a school mark lower than the examination mark, the examination mark is the final mark.

Transitional Provisions

During the 1983-84 school year, Alberta Education will recognize all course credits earned prior to September 1, 1983, for the purpose of awarding the General High School Diploma.

Students who have completed partial requirements for the Advanced High School Diploma prior to September 1, 1983, and who are enrolled in Grade 12 courses during the 1983-84 school year, may apply any of the previously completed required diploma examination subjects toward a diploma, provided they have earned a final course mark of 50% or better in each subject.

Award of Excellence

When candidates for an Advanced High School Diploma obtain a final average of 80% or higher on the four required diploma examination courses with not less than 65% in any one of these four required courses, they receive an Award of Excellence. This Award of Excellence is noted on the student's Advanced High School Diploma. When a student writes two or three of the diploma examinations in Biology 30, Chemistry 30, and Physics 30, the highest of these final course marks is used for diploma purposes and in the calculation of the average for the Award of Excellence.

CHAPTER 2

Description of the Examination

This chapter outlines the procedures that were followed during examination development, and discusses the structure and content of the examination. Sample questions from the January 1984 examination are included.

Examination Development

There were three stages in the development of the January 1984 Mathematics 30 Diploma Examination: preparation of curriculum specifications, development of questions, and selection of questions for the final copy.

1. Curriculum Specifications

   The Curriculum Branch of Alberta Education prepared curriculum specifications based on the topical outline of the Mathematics 30 core described in the *Program of Studies for Senior High Schools*. In these specifications, weightings were assigned to each major content area and to specific topics outlined in the *Program of Studies*. These weightings were based on the emphasis that each topic was to receive in the Mathematics 30 program. The curriculum specifications were distributed to all school jurisdictions in the province.

   Topic statements upon which specific examination questions were based, along with sample questions for each topic, are given in this chapter.

2. Development of Questions

   Committees composed of teachers and Student Evaluation Branch personnel wrote questions to reflect the content statements listed in the curriculum specifications. The questions were field-tested, and revisions were made on the basis of teacher recommendations and the field test results.

3. Final Copy

   A test development specialist, assisted by groups of classroom teachers, built the examination from suitable questions. These committees selected questions from the various content areas, so that each area received the emphasis recommended in the curriculum specifications. An Examination Review Committee checked the proposed examination for content validity, accuracy, and technical merit, and further changes were made in accordance with their recommendations.

Examination Description

The Mathematics 30 Diploma Examination addressed all core topics of the course. The per cent emphasis placed on each topic reflects the examination specifications sent to the schools by the Student Evaluation Branch.

Content Area	Emphasis in % of the Total Examination Mark
Trigonometry	22
Quadratic Relations	20
Sequences, Series, and Limits	18
Statistics	12
Logarithms	14
Polynomial Functions	14

The examination consisted of parts A and B. Part A consisted of 52 multiple-choice questions worth 80% of the total examination mark. It covered the six subject strands of trigonometry; quadratic relations; sequences, series, and limits; statistics; logarithms; and polynomial functions. The questions measured the four taxonomic levels of knowledge, comprehension, application, and open search. Knowledge questions test recall of facts, definitions, rules, theories, and the ability to do routine computations. Comprehension questions test understanding of principles and concepts, interpretation, translation, and the ability to perform algorithms. Application questions test the ability to solve type problems. Open search questions test the ability to solve novel problems, prove new results, and transfer knowledge to a context in which there has been no practice.

Part B consisted of five written-response questions worth a total of 13 marks, which represented 20% of the total examination mark. It covered the five subject strands of trigonometry; quadratic relations; sequences, series, and limits; logarithms; and polynomial functions. The questions measured three of the four taxonomic levels: comprehension, application, and open search.

The taxonomic classification of examination questions depends on the manner in which the content has been covered in the classroom. A question that is an application question for one class may be a knowledge question for another class.

The time allotted for the Mathematics 30 Diploma Examination was two and one-half hours.

The classification of questions according to subject strand and taxonomic level is presented in Table 1.

Table 1

January 1984 Mathematics 30 Diploma Examination Blueprint

Subject Strand	Question by Taxonomic Level				Examination Emphasis
	Knowledge	Comprehension	Application	Open Search	
Trigonometry	2,7	1,4,8,9	3,5,6,10 [1]	11	22%
Quadratic Relations	17	12,14,15,20	13,16,18,21, 22, [2]	19	20%
Sequences, Series, Limits	23	24,26,28,29	27,30,31 [3]	25	18%
Statistics	33	32	34,36,38	35,37,39	12%
Logarithms	40	41,43,44	42,45	[4]	14%
Polynomial Functions	49	47,48,51 [5]	46,50,52		14%
Emphasis	11%	32%	47%	14%	100%

Note: Numbers in brackets [ ] indicate the written-response questions.

Description of Subject Strands and Sample Multiple-Choice Questions

The topics that were tested within each strand are listed, and sample questions from the examination are provided. The correct response for each question is identified by an asterisk and the percentage of students selecting each alternative is given.

1. Trigonometry

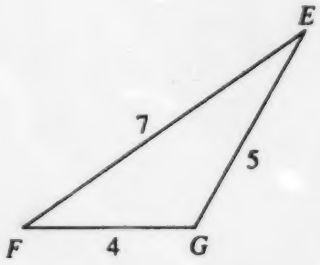
Questions related to trigonometry measure the ability to:

- describe circular paths on the unit circle
- determine co-ordinates of points on the unit circle
- define trigonometric ratios in terms of co-ordinates of points on the unit circle
- find the domain and range of the six trigonometric functions
- solve simple trigonometric equations
- derive and apply trigonometric identities
- define periodic functions and radian measure
- solve problems involving sine and cosine laws

The following question is at the application level, and measures the ability to solve problems involving trigonometric functions.

Question 10:

In the diagram to the right, the measure of $\angle F$ to the nearest degree is



Student Responses

73.8%	*A	44°
15.0%	B.	46°
4.3%	C.	48°
6.5%	D.	52°
0.3%		no response

2. Quadratic Relations (Conic Sections)

Questions related to quadratic relations measure the ability to:

- solve systems of linear equations in two variables
- state definition of the circle; derive the standard form
- convert the equation of a circle from standard to general form
- determine the equation of a circle and sketch the graph from given conditions (e.g., centre and radius; centre and a point; three points)
- define a parabola, and identify terms such as focus, vertex, axis, and directrix
- solve problems related to the parabola
- define and identify an ellipse and the terms: foci, major axis, minor axis, vertices, and focal radii
- derive the standard form of the equation of the ellipse
- solve problems related to the ellipse
- define and identify a hyperbola and the terms: vertices, foci, transverse axis, conjugate axis, and asymptotes
- derive the standard form of the equation of the hyperbola
- solve problems related to the hyperbola

The following question is at the knowledge level, and measures the ability to write the length of the major axis for a given ellipse.

Question 17:

The length of the major axis of the ellipse $\frac{x^2}{3} + y^2 = 1$ is

Student Responses

24.8%	A.	$\sqrt{3}$
53.0%	*B.	$2\sqrt{3}$
3.7%	C.	2
18.4%	D.	6
0.1%		no response

3. Sequences, Series, and Limits

Questions related to sequences, series, and limits measure the ability to:

- recognize the difference between a sequence and a series; recognize the difference between finite and infinite sequences
- apply formulas to problems involving arithmetic sequences and series
- apply formulas to problems involving geometric sequences and series with special emphasis on the mathematics of finance
- determine the limits of various functions
- solve problems involving infinite geometric series

The following question is at the comprehension level, and measures the ability to use the general term formula for a geometric sequence.

Question 26:

The number of terms in the geometric sequence 2, 4, . . . , 512 is

Student Responses

4.0%	A.	10
82.0%	*B.	9
9.4%	C.	8
4.5%	D.	7
0.1%		no response

4. Presentation of Data and Descriptive Statistics

Questions related to statistics measure the ability to:

- recognize measures of central tendency and measures of dispersion
- develop and apply standard deviation and z-scores
- apply probability to theoretical frequency distribution
- do probability using an experimental approach

The following question is at the open-search level, and measures the ability to solve non-routine problems involving the normal distribution.

Question 35:

From previous observations, police know that the speeds of cars in a 60 km/h zone are normally distributed about a mean of 63 km/h with a standard deviation of 3 km/h. A radar speed trap is set up in a 60 km/h zone and the speeds of 150 cars are monitored. If the police must allow 10% of the posted limit as a margin for error, the expected number of cars stopped for speeding is

Student Responses

12.1%	A.	126
10.4%	B.	99
21.9%	C.	51
55.1%	*D.	24
0.5%		no response

5. Logarithms

Questions related to logarithms measure the ability to:

- identify and graph exponential functions
- convert equations from exponential form to logarithmic form and vice versa
- solve logarithmic equations by converting to exponential form
- state and use the basic laws or properties of logarithms for products, quotients, powers, and roots
- use logarithms to solve practical problems

The following question is at the comprehension level, and measures the ability to solve logarithmic equations by converting to the exponential form.

Question 41:

If $\log_a\left(\frac{1}{8}\right) = 3$, then the value of a must be

Student Responses

15.4%	A.	$\sqrt[3]{3}$
74.9%	*B.	$\frac{1}{2}$
6.8%	C.	24
2.8%	D.	$3\frac{1}{8}$
0.1%		no response

6. Polynomial Functions

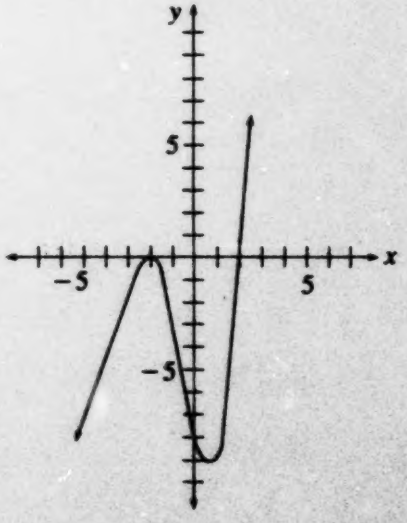
Questions related to polynomial functions measure the ability to:

- classify a polynomial function according to degree
- write polynomial functions in descending order of degree
- divide integral polynomial functions in one variable by a binomial of the form $x - a$, $a \in I$ using long division and synthetic division
- find factors of integral polynomial functions
- determine the x-intercepts of integral polynomial functions where $x \in Q$
- sketch the graph of the integral polynomial function

The following question is at the application level, and measures the ability to sketch graphs of integral polynomial functions.

Question 52:

The graph to the right is the graph of one of the functions below. The function is



Student Responses

56.1%	*A.	$y = x^3 + 2x^2 - 4x - 8$
19.6%	B.	$y = x^3 - 2x^2 - 4x + 8$
14.4%	C.	$y = x^3 - 4x$
7.9%	D.	$y = -x^3 + 4x$
2.1%		no response

Written-Response Questions

Performance on written-response questions indicates the extent to which students can write the logical steps involved in the solution of a problem.

Each written-response question from the examination is given on the following pages with an appropriate answer. The total marks possible for each question is given, along with the average number of marks awarded. The distribution of marks awarded to students for each written-response question is shown in Table 7, Chapter 3.

Question 1 requires the student to choose the applicable trigonometric function, then use it correctly.

> The angle of elevation to the top of a building is 30°. When you move 20 m closer to the building, the angle of elevation becomes 45°. How tall is the building? (Answer to the nearest metre if not exact.)

Key:

$$\frac{20}{\sin 15^\circ} = \frac{z}{\sin 30^\circ} \quad \text{or} \quad \frac{20}{\sin 15^\circ} = \frac{y}{\sin 135^\circ}$$

$$z = \frac{20 \sin 30^\circ}{\sin 15^\circ} \qquad y = \frac{20 \sin 135^\circ}{\sin 15^\circ}$$

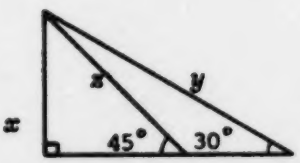
$$= \frac{20(0.5)}{0.2588} \qquad = \frac{20(0.707)}{0.2588}$$

$$= 38.6398 \qquad = 54.6367$$

$$x = \frac{38.6398 \sin 45^\circ}{\sin 90^\circ} \qquad x = \frac{54.6367 \sin 30^\circ}{\sin 90^\circ}$$

$$= 27.32 \qquad = 27.32$$

OR $x = \sqrt{\frac{(38.6398)^2}{2}}$



height = 27 m

Key: $\cot 30° = \frac{d + 20}{x}$ $\cot 45° = \frac{d}{x}$

$x \cot 30° = d + 20$
$x \cot 45° = d$

$x(\cot 30° - \cot 45°) = 20$

$$x = \frac{20}{\cot 30° - \cot 45°}$$

$$= \frac{20}{1.7321 - 1} = 27.32$$

height = 27 m

It was possible to score 3 marks for this question. The average number of marks awarded to students was 1.4.

Question 2 requires the student to determine the semi-major and semi-minor axes of an ellipse embedded in the given data.

A scoreboard is at one focus of an elliptical racetrack. The farthest point of the track from the scoreboard is 1008 m and the closest point is 400 m. If the racetrack is of the form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, determine the numerical values of a and b.

Key: $a = \frac{1008 + 400}{2} = 704$

$c = 704 - 400 = 304$

$b^2 = a^2 - c^2$

$b = \sqrt{495\,616 - 92\,416}$

$= \sqrt{403\,200}$

$= 634.98$

$a = 704$ m
$b = 635$ m

If the answer is written as $\frac{x^2}{(704)^2} + \frac{y^2}{(635)^2} = 1$, give 1 mark.

It was possible to score 2 marks for this question. The average number of marks awarded to students was 0.67.

Question 3 requires the student to apply a geometric series formula to a problem involving the mathematics of finance.

George deposits a certain amount of money each half year in a fund that bears interest at 8% compounded semi-annually. What sum must be deposited so that, immediately after the 4th deposit has been made, $470 will be available? (Answer to the nearest cent.)

Key: $r = 1.04$; $n = 4$; $S_n = 470$; $a = ?$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$470 = \frac{a[(1.04)^4 - 1]}{1.04 - 1}$$

$$470 \times 0.04 = a(0.169\ 86)$$

$$110.67 = a$$

(accept $110.66 to $110.68) $110.67

It was possible to score 3 marks for this question. The average number of marks awarded to students was 0.56.

Question 4 requires the student to solve a system of logarithmic equations by first converting them to the exponential form.

If $\log_{m+n} 81 = 4$ and $\log_{m-n} 64 = 6$, find the values for m and n.

Key: $(m+n)^4 = 81$ and $(m-n)^6 = 64$

$m + n = 3$ $\qquad$ $m - n = 2$

$$\begin{aligned} m + n &= 3 \\ m - n &= 2 \\ \hline 2m &= 5 \end{aligned}$$

$$m = 2\frac{1}{2}$$

$$n = 3 - 2\frac{1}{2}$$

$$= \frac{1}{2}$$

$m = 2\frac{1}{2}$; $n = \frac{1}{2}$

It was possible to score 3 marks for this question. The average number of marks awarded to students was 1.4.

Question 5 requires the student to determine the x-intercepts for the graph of an integral polynomial function.

Find the x-intercepts for the graph of $y = x^3 - 2x^2 - x + 2$.

Key:

$$x^3 - 2x^2 - x + 2 = 0$$

$$x^2(x - 2) - (x - 2) = 0$$

$$(x - 2)(x^2 - 1) = 0$$

$$(x - 2)(x - 1)(x + 1) = 0$$

$$x = 2;\ 1;\ -1$$

It was possible to score 2 marks for this question. The average number of marks awarded to students was 1.2.

CHAPTER 3

Results

Validity and Reliability

The content validity of the examination was established by the procedure for examination development outlined in Chapter 2. Each question was mapped to a specific topic statement defining some aspect of the curriculum. The Examination Review Committee evaluated each question, and the examination as a whole, for content validity.

The KR-20 coefficient for the multiple-choice portion of the examination was 0.85, and Cronbach's alpha for the total test was 0.87. These values are very satisfactory for an achievement test measuring a broad range of concepts and skills.

The inter-marker reliability for the marking of the written-response questions was also examined. The marking key for each question was prepared by the Student Evaluation Branch and then revised following discussion with four head markers. During the orientation session, teachers marked three common student responses for each question and discussed the awarding of marks. All teachers then marked an additional three student responses for each question so that the consistency of the marking procedures could be checked. At the beginning of each morning and afternoon marking session, all teachers marked two common student responses for each question. Any discrepancies were again discussed. For questions on those papers marked by all teachers, 76.2% of the marks awarded were in agreement, 21.2% deviated from the consensus mark by one mark, and 2.6% deviated by more than one mark. During the marking, one teacher marked questions 1 and 3, and a different teacher marked questions 2, 4, and 5 for each paper.

Provincial Averages

The classification of examination questions according to subject matter topic and taxonomic level has been presented in Table 1, Chapter 2. Subtest scores were computed for each of the six subject matter topics, and for the four taxonomic levels. Table 2 contains the provincial averages for these subtests and for the total examination. In each case, an average is given for the the written-response questions, multiple-choice questions, and the combination of the two (total). Averages are based on raw scores, which are the number of marks obtained on each subtest. The total marks possible is identified for the written-response and multiple-choice components of each subtest. For the multiple-choice component of each subtest, the average in per cent is also given.

Averages are based on 7568 students. Differences between total averages and component averages are due to rounding.

Table 2

Provincial Averages for Subtests

Subtest	Total Marks Possible		Raw Score Averages		
	Written-Response	Multiple-Choice	Written-Response	Multiple-Choice	Total
Subject Strands					
Trigonometry	3	11	1.4	7.0 (63.6%)	8.4
Quadratic Relations	2	11	0.67	6.3 (57.2%)	7.0
Sequences, Series, and Limits	3	8*	0.56	5.5 (68.7%)	6.1
Statistics	0	8	--	5.3 (66.2%)	5.3
Logarithms	3	6	1.3	4.6 (76.7%)	5.9
Polynomial Functions	2	7	1.2	4.5 (64.3%)	5.7
Taxonomic Levels					
Knowledge	0	7	--	4.6 (65.7%)	4.6
Comprehension	2	18	1.2	12.1 (67.2%)	13.3
Application	8	20	2.7	13.2 (66.0%)	15.9
Open Search	3	6	1.3	3.2 (53.3%)	4.5
TOTAL EXAMINATION	13	51	5.2	33.2 (65.1%)	38.4

*Question 28 was omitted because of a typographical error.

The standard deviation for the total examination was 10.9 raw score points.

The multiple-choice averages in per cent provide an indication of how well students performed within subject strands and taxonomic levels. The average for the multiple-choice questions on logarithms was considerably above the overall average for the multiple-choice questions. The average for the multiple-choice questions on quadratic relations was considerably below the overall average for the multiple-choice questions. The average for the open search questions was also very low.

It is not meaningful to compare total subtest scores or written-response subtests scores across topics or taxonomic levels because of the uneven distribution of written-response questions. However, jurisdictions and schools can compare their averages to the provincial averages to help identify strengths and weaknesses in their programs.

Comparison of Multiple-Choice and Written-Response Questions

The average mark attained on all multiple-choice question was 65.1%, and the average attained on all written-response questions was 40.0%. It is not readily apparent why the written-response questions were answered so poorly.

In this section, each written-response question is discussed in relation to a comparable multiple-choice question.

Question 1 requires the student to choose the applicable trigonometric function, then use it correctly. The difficulty level is 0.47. Question 10, a multiple-choice question testing the same concept, has a difficulty level of 0.74.

Question 2 requires the student to determine the semi-major and semi-minor axes of an ellipse embedded in the given data. The difficulty level is 0.34. Question 18, a multiple-choice question testing the same concept, has a difficulty level of 0.46.

Question 3 requires the student to apply a geometric series formula to a problem involving the mathematics of finance. The difficulty level is 0.19. Question 26, a multiple-choice question testing the same concept, has a difficulty level of 0.82.

Question 4 requires the student to solve a system of logarithmic equations by first converting them to the exponential form. The difficulty level is 0.47. Question 42, a multiple-choice question testing the same concept, has a difficulty level of 0.87.

Question 5 requires the student to determine the x-intercepts for the graph of an integral polynomial function. The difficulty level is 0.60. Question 51, a multiple-choice question testing the same concept, has a difficulty level of 0.46. Question 5 is the only written-response question with a difficulty level above 0.50.

Standard-Setting

Every effort was made to design a Mathematics 30 diploma examination that would be a valid and reliable measure of what students can be expected to know as a result of instruction in this course. A specific standard or level of expectation inherent in the examination was established through careful test development procedures. To ensure that each form of the examination administered in 1984 will be parallel to each other, the Student Evaluation Branch has adopted a process of standard-setting. One way to review the standards inherent in each examination is to involve classroom teachers in making judgments about the difficulty of the examination.

The teachers who marked the written-response portion of the examination reviewed the difficulty level of each question in terms of a borderline passing student (who merits 50%), a borderline "B" student (who merits 65%), and a borderline "A" student (who merits 80%). After teachers gave their initial judgments on question difficulty, they were given information about the actual distribution of students' examination marks. They were then given the opportunity to modify their judgments. Judgments from all teachers for all examination questions were pooled to determine the examination scores that teachers felt should be set equivalent to 50%, 65%, and 80%. For the January 1984 diploma examination, teachers felt that 44% should be raised to 50%, that 63% should be raised to 65%, and that 80% should be left at 80%. These cut-off scores are based on the judgments of 48, 24, and 24 teachers respectively.

Transformation of Examination Marks

The final decision on the transformation to be applied to the examination scores was based on an analysis of the data from the teachers' judgments, the distribution of examination marks, the distribution of school marks, and the distribution of marks in previous years. The examination marks were adjusted according to the transformation presented in Table 3.

Table 3

Transformation of Examination Marks

Actual Examination Marks (%)	Adjusted Examination Marks (%)
0 - 44	0 - 47
45 - 63	50 - 64
64 - 79	65 - 79
80 - 100	80 - 100

Scores between the two end points of each interval were converted according to linear transformation. Additional adjustments were made to the examination marks so that students would not receive final blended marks of 48% or 49%.

The overall effect of the transformation was to raise the average from 60.0% to 62.1%.

Relationship Between Examination Mark and School Mark

The provincial averages and standard deviations for the school-awarded mark, the transformed examination mark, and final blended mark are presented in Table 4.

Table 4

Summary Statistics for School Mark, Examination Mark, and Final Mark

	School-Awarded Mark	Examination Mark	Final Blended Mark
Average	65.3%	62.1%	64.1%
Standard Deviation	14.2%	15.7%	14.0%

The average school mark was 3.2% higher than the average examination mark after transformation. The correlation between school mark and examination mark was 0.74, which indicates a fairly close agreement in the rank ordering of the students based on the two sets of marks.

The percentages of students receiving A's, B's, C's, and F's are presented in Table 5 for the school mark, examination mark, and the final blended mark.

Table 5

Percentages of Students Receiving A's, B's, C's, and F's

Score	School-Awarded Mark	Examination Mark	Final Blended Mark
A(80-100%)	18.7	15.6	15.2
B(65-79%)	33.0	26.3	32.1
C(50-64%)	37.2	38.2	40.5
F(0-49%)	11.1	19.9	12.2

Results for Individual Questions

Multiple-Choice Questions

The percentage of students choosing each response for each multiple-choice question is given in Table 6. The correct response for each question is also identified.

Table 6

Results for Individual Multiple-Choice Questions

ITEM	KEY	Distribution of Responses in %*				ITEM	KEY	Distribution of Responses in %*			
		A	B	C	D			A	B	C	D
1	A	43.3	18.9	26.2	11.2	27	C	15.8	8.8	62.6	12.2
2	D	17.1	33.5	11.3	37.9	28	**				
3	D	7.6	9.2	21.3	61.6	29	A	75.5	11.5	8.3	4.5
4	A	47.2	21.9	11.0	18.7	30	B	19.8	59.9	15.9	4.1
5	C	2.9	8.7	84.4	4.0	31	B	7.7	44.5	14.2	33.1
6	B	11.0	81.0	3.9	3.7	32	C	2.3	9.4	80.0	8.2
7	C	4.5	3.7	73.5	18.1	33	B	3.4	67.0	6.1	23.4
8	B	5.6	69.5	21.7	3.2	34	B	7.5	66.0	6.8	19.4
9	C	4.4	1.3	83.6	10.6	35	D	12.1	10.4	21.9	55.1
10	A	73.8	15.0	4.3	6.5	36	A	90.9	3.5	3.5	1.9
11	D	11.2	8.8	35.0	44.3	37	D	3.0	15.9	8.9	72.0
12	D	9.3	4.6	8.1	78.0	38	D	4.0	4.5	24.6	66.6
13	C	11.7	27.7	51.3	9.0	39	A	27.6	22.3	22.1	27.4
14	A	50.1	14.5	22.5	12.8	40	C	3.4	5.2	77.8	13.5
15	D	27.4	2.2	2.3	68.1	41	B	15.4	74.9	6.8	2.8
16	B	3.8	71.5	15.0	9.0	42	C	4.0	3.4	86.6	5.8
17	B	24.8	53.0	3.7	18.4	43	A	84.1	5.5	5.1	5.1
18	A	46.1	18.1	14.2	21.5	44	D	21.4	11.6	15.3	51.4
19	D	29.2	6.8	10.5	53.3	45	B	9.3	80.6	6.2	3.8
20	C	6.5	3.6	67.1	22.6	46	B	8.0	80.0	9.1	2.7
21	D	19.7	14.1	19.4	46.5	47	A	69.6	9.9	12.8	7.5
22	A	49.1	12.8	30.5	7.2	48	C	12.4	28.0	47.0	12.2
23	C	17.3	8.6	68.6	5.4	49	B	3.2	84.4	8.9	3.3
24	B	2.4	93.4	3.4	0.8	50	A	65.1	18.2	10.5	5.8
25	C	19.8	6.8	65.1	7.8	51	B	6.2	46.2	17.4	28.9
26	B	4.0	82.0	9.4	4.5	52	A	56.1	19.6	14.4	7.9

*The sum of the percentages may total less than 100% as there is no entry for "no response." This is less than or equal to 2% for all questions.

**Question 28 was omitted due to a typographical error.

Written-Response Questions

The percentage of students awarded each mark for each question is given in Table 7.

Table 7

Distribution of Marks for Written-Response Questions

Question Number	Percentage of Students Obtaining Each Mark				
	NR*	0	1	2	3
1	1.9	44.8	5.5	4.5	43.3
2	9.2	50.6	13.4	26.8	
3	9.7	69.0	3.3	1.2	16.8
4	17.5	23.2	17.9	6.9	34.5
5	15.3	14.2	20.4	50.0	

*NR - No Response

The total number of marks possible, the average mark awarded to students, and the difficulty levels for the written-response questions are summarized in Table 8. The difficulty level is the average divided by total marks possible.

Table 8

Average Mark Awarded For Written-Response Questions

Question Number	Total Marks	Average	Difficulty Level
1	3	1.4	0.47
2	2	0.67	0.34
3	3	0.56	0.19
4	3	1.4	0.47
5	2	1.2	0.60

POOR

QUALITY

ORIGINAL